CorSalud 2017 Apr-Jun;9(2):128-131

CorSalud

Cuban Society of Cardiology

Letters to the Editor

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Sudden cardiac death: A challenge for modern cardiology

Muerte súbita cardíaca: Un reto para la cardiología moderna

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Received: March 31, 2017
Accepted: June 12, 2017

Key words: Sudden death, Cardiovascular diseases, Coronary artery disease, Cardiac arrhythmias

Palabras clave: Muerte súbita, Enfermedades cardiovasculares, Enfermedad arterial coronaria, Arritmias cardíacas

To the Editor,

Sudden cardiac death (SCD) is one of the leading causes of death worldwide and it accounts for half of all deaths of cardiovascular origin; it is also a multifactorial problem that is expected to raise in coming years as a result of the coronary disease's increase, which is an important challenge for modern cardiology.

Its definition has been the subject of controversy and it has caused difficulties in its registration, which has led to the absence of comparable epidemiological data among different populations.

The SCD is defined as a natural unexpected death, rapidly evolved –because it does not respond to violent causes– and generally, with no previous symptoms; if there were any, minutes past (less than sixty) before death takes place[1], and in which –even, with knowledge of a preexisting cardiac disease– the way it appears is unexpected[2].

When there is no an eyewitness, the deceased must have been last seen alive and in stable condition the last 24 hours before finding him/her dead[3]. In the cases where the patient is maintained with artificial support and death is delayed, it is considered sudden if it occurs in a greater than six-hours-term, by the use of such interventions[4-5]. For pathologists, there is an interval up to six hours to define it, during which time, histological signs of ischemia are presented[6].

EPIDEMIOLOGY

It has been estimated an annual charge of about 4-5 million of SCDs in the world[3], thus, it is the third leading cause of death worldwide, surpassed only by the sudden deaths of non-cardiac origin and cancer[7].

Muratore *et al.*[8] suggest that the estimation of the rate of sudden death in the general population is obtained from data extracted of death certificates, a methodology that may be limited and imprecise; while Ochoa *et al.*[9] mention that one of the biggest statistical problems of this disease is the variability in its incidence reports, which generate significant differences in rates of different countries.

The SCD is more frequent in the out-of-hospital setting[8], in men[10], and during winter[1]. Brugada[11] mentioned two peaks of incidence, the first until six months of life and the second between 45 and 65 years old; while other authors[4,10] mention that the second age ranges between 75 and 85 years.

There are differences in the places where the SCD occurs in both sexes. Men usually wait longer before seeking medical attention; hence, there is greater incidence of SCD at home, work and social places. On the other hand, women, once the onset of symptoms, seek medical attention more quickly, which explains that its occurrence is more frequent at hospitals[5].

ETIOPATHOGENESIS

It has been shown that the SCD is the most frequent form of death in patients with ischemic heart disease and it is the first manifestation of this disease up to 20% of cases[12]. Asmundis and Brugada[10], and Palacios-Rubio and Núñez-Gil[13] mentioned that the SCD occurs because of several causes that vary with age (**Box 1**). Between 75-80% of episodes are of coronary origin[1], wherein the ischemia triggers ventricular tachyarrhythmia processes[4]. Between 15-20% is related to structural heart disease, congenital or acquired, such as hypertrophic and dilated cardiomyopathy, heart failure, right ventricular arrhythmogenic dysplasia, and valvular and hypertensive heart diseases, among others. The remaining 5% is related to a primary electrical source and a positive family history, as the long QT, Brugada and Wolff-Parkinson-White syndromes, among others[1,10,13].

Box 1. Causes of sudden cardiac death related to age.

Under 40 years of age	Older age
Hereditary electric diseases	Coronary artery disease
Ventricular arrhythmias	Ischemic heart disease
Coronary congenital anomalies	Structural heart disease

The different predisposing factors involve mechanical and structural changes which make the heart vulnerable. If, subsequently, sudden death trigger factors show, electrical alterations may appear (ventricular fibrillation is the most common) that impair pumping function and which are ultimately responsible for the SCD, which −as it is understandable− is not an isolated episode, but the ending of a series of events[1].

RISK FACTORS AND CLINICAL MANIFESTACIONS

The risk factors related to the SCD have been studied in multiple research studies (**Box 2**)[2,7-10]. The high blood pressure and ischemic heart disease are independent risk factors for the SCD, both have a markedly and directly linked to the presence of atherosclerotic lesions in the coronary vascular tree, as evidence of the role of atherosclerosis in the etiopathogenesis of this phenomenon[14]. Despite the knowledge of the medical records frequently presented, a high percentage of these patients have an SCD as the first sign of disease without any symptoms or previous history[13].

The main feature of the SCD is the abrupt loss of consciousness, as an expression of insufficient cardiocerebral spending[7]; nevertheless, patients who suffer it may have prodromal and premonitory symptoms, including those recognized: increased angina and nonspecific chest discomfort, presence of palpitations, fatigability, loss of consciousness, shortness of breath, coldness, pallor and sweating[7]. Some factors, like the patient's age, are related to specific symptoms. Vigo-Ramos[15] exposes that the loss of consciousness is most common in people under 45 years, and dyspnea, accompanied by palpitations, in people over 60.

Box 2. Some risk factors of sudden cardiac death.

Risk factor
Advanced age (>70 years)
Family records of sudden cardiac death
Personal records of myocardial infarction
High blood pressure
Diabetes mellitus
Dyslipidemia
Ischemic heart disease
Syncope
Body mass index >30 kg/m^2
High levels of NT-proBNP and PIP
Left bundle branch block
Severe left ventricular hypertrophy
Left atrium size > 45 mm
Gradient in the left ventricular outflow tract
Non-sustained ventricular tachycardia (in the Holter)
Flow redistribution on chest X-ray
Flat or decreased response of the BP in the exercise

BP, blood pressure; NT- proBNP, N-terminal pro-brain natriuretic peptide; PIP, procollagen type I propeptide

DIFFERENTIAL DIAGNOSIS

In patients with sudden death, a primary cause must be searched, and it is necessary to preclude firstly those with recovery possibility, as the acute coronary syndrome, the electrolyte disorders, drug use and myocarditis, among others. In addition, a complete medical evaluation must be performed to rule out non-cardiac causes as: tension pneumothorax, hemorrhagic shock, severe hypoxia, acidosis, massive pulmonary thromboembolism and cardiac tamponade[2].

CONDUCT TO BE FOLLOWED

When assisting a patient with SCD, the physician must start the "survival chain" composed by four links: activation of emergency medical services, basic-immediate cardiopulmonary resuscitation (CPR), early defibrillation and early-advanced CPR.

The emergency service network must have clear knowledge of the geographical areas, protocols for identification of patients at risk and a transportation service with adequate personnel and equipment. An efficient service network is the key to success in situations where the patient's life is in danger[16].

The CPR with early defibrillation should be provided in the place where the SCD occurred and by the first person who recognizes the cardiorespiratory arrest, because the time from the collapse to the initiation of the CPR and its duration has important prognostic implications[16].

During resuscitation, a rapid and accurate diagnosis should be achieved through the correct use of few tests. The electrocardiogram can diagnose an acute coronary syndrome or malignant arrhythmia and the arterial blood gas analysis detects possible alterations[13]. After stabilizing the patient and identifying the cause of sudden death, a specific and timely treatment should be initiated. Loma-Osorio *et al.*[12] demonstrated that improving education in CPR, early defibrillation access or the existence of systems based on telephone support, also improve the chances of survival.

STRATIFICATION OF PATIENTS[7]

- High risk: Patients with structural heart disease associated with coronary heart disease (myocardial dysfunction with left ventricular ejection fraction < 35%), or those in which severe ventricular arrhythmias are demonstrated. The greatest therapeutic benefit in this group is the use of the implantable cardioverter-defibrillator, together with the pharmacological treatment.
- Medium risk: Patients with acquired structural heart disease (hypertensive, valvular, coronary or congenital), after ruling out the acute ischemia and severe ventricular arrhythmias. The greatest benefit, proved through the evidence, was achieved by the pharmacological treatment, which stops or slows the progression of the heart disease.
- Low risk: General population with cardiovascular risk factors such as diabetes mellitus, dyslipidemia, high blood pressure, sedentary lifestyle, smoking. The interventions should be focused on pharmacological measures or not, aimed at modifying the lifestyle and controlling risk factors.

PROGNOSIS

Barberia *et al.*[17] indicated that there are three factors affecting the prognosis: electrical instability, ventricular dysfunction and residual ischemia (cardiac complications); instead, Loma-Osorio *et al.*[12] mention the neurological complications as the main cause of a poor vital and functional prognosis.

The mortality rate in patients experiencing an acute coronary syndrome is high, despite receiving appropriate treatment[18]. Priori *et al.*[19] report that the socioeconomic conditions of the country where the SCD takes place are an important factor in the prognosis, because, in developed countries, these patients have an increasing survival.

COMPETING INTERESTS

None

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